

REMARKS

The Examiner has objected to the drawings because of inconsistencies between the specification and the drawings. Accordingly, the Applicant has amended the specification to render it consistent with the drawings.

The Examiner has objected to the Specification, asserting that the Title of the Invention is not descriptive. Accordingly, the Applicant has amended the Title of the invention to render it more descriptive of the claimed invention. The Examiner has also objected to the specification because of an inconsistency in element numbers. Accordingly, the Applicant has amended the specification to fix this inconsistency.

The Examiner has rejected claims 21-24 as being anticipated by Aoshima et al. (US 6,556,391) Aoshima teaches a tunnel valve having a hard bias structure that includes a magnetic layer that is exchange coupled with a layer of antiferromagnetic material (AFM layer) formed thereover. Aoshima teaches that the layer of antiferromagnetic material is electrically insulating in order to prevent shunting of current between the top and bottom leads through the magnetic layer. Aoshima also teaches that an insulation layer can be deposited under the magnetic layer to further prevent shunting of current between the leads.

The AFM layer formed over and exchange coupled with the magnetic layer, strongly pins the moment of the underlying magnetic material. This pinned moment of the magnetic material is then used to bias the free layer. However, the addition of an AFM layer over the magnetic layer results in a complex hard bias structure that is difficult to manufacture, and which results in excessively tall topography. As those skilled in the art can appreciate, in order for an AFM layer to effectively exchange couple with a magnetic material and pin the moment of the magnetic material, the AFM layer must be very large. This results in a very thick bias structure outside of the active

area of the sensor as can be witnessed by the need to include a conductive gap layer between the (element 9 in Fig. 3) to make up for the large distance required between the leads 11, 12 to accommodate the thick hard bias structure.

The present invention does not require a thick AFM layer to pin the moment of the hard bias layer. Nor does it need an insulating layer beneath the hard bias layer. By making the hard bias layer of an electrically insulating, hard magnetic material having, a much simpler, thinner, effective hard bias structure can be made. The hard bias layer maintains its magnetic moment oriented in a desired direction by its high coercivity (magnetic hardness) without the need for an AFM layer. Because the hard bias material is electrically insulating, it does not require an electrically insulating AFM layer formed above, or an insulation layer formed below. This allows the hard bias structure to be constructed in a single deposition extending from the first lead to the second lead and allows the space between the leads to be much thinner. The thin space between the leads creates a flat topography for patterning the second lead on top of the hard bias layer and also minimizes the space between the leads. Since the leads are constructed of a magnetic material and act as magnetic shields as well as leads, the space between the leads determines the bit length. Therefore, keeping the space between the leads small decreases bit length and increases data capacity and data rate.

The Applicant has amended the claims to more clearly point out that the hard bias layer consists of a layer of hard magnetic material that extends from one lead to the other. As amended, claims 21-24 are unique from and not anticipated by the prior art.

The Applicant, sincerely believes that the Amendment C is now in condition for consideration, and respectfully requests that the Examiner consider these amended claims. A notice of allowance is also sincerely requested. Should the Examiner wish to discuss this matter further, the Examiner is invited to call the Applicant's attorney at (408) 971-2573.

For payment of any fees due in connection with the filing of this paper, the Commissioner is authorized to charge such fees to Deposit Account 50-2587.

Respectfully submitted,

By: 

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